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Examined Utility Model Showa 57-154409

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Application for Utility Model Registration (2)

(4,000 yen)

March 26, 1981[1]

Haruki Shimada, Director-General of the Patent Office

1. Title of the Device: Distal electrode for electric scalpel

2. Creator

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5. List of Attached Documents

(1) Specification	1 copy	(2) Drawings	1 copy
(3) Application duplicate	1 copy	(4) Power of Attorney	1 copy
(5) Examination Request	1 copy		

Examination on Formalities [Stamped]

[Stamp: Baba]

[Stamp: Patent Office; March 2?, 1981]

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[1] Here and elsewhere on the page appears the stamp "Teki", which could be an abbreviation of "applicable" or "appropriate", or something else. There is also a faded, illegible stamp partially covering the two revenue stamps; it may be a cancellation stamp.

[2] Stamped with this person's seal

Specification

1. Title of the Device

Distal electrode for electric scalpel

2. Scope of the Utility Model

An AC-coupled type distal electrode for an electric scalpel, in which the surface of the electrode portion is covered by an insulating film, characterized in that a monitor electrode portion is internalized in the above insulating film, separated from the above electrode portion.

3. Detailed Explanation of the Device

This device concerns an AC-coupled type distal electrode for an electric scalpel, having, in addition to an electrode portion, a monitor electrode portion.

Distal electrodes for conventional electric scalpels are for the most part DC-coupled type devices, in which the patient is placed directly on the electrode portion; hence a metal part, physiological saline solution or conductive molded part is present on the surface of this electrode portion, and during inspections prior to use, or when problems occur during use, it is easy to discover the site requiring repair and to take appropriate measures. However, in the case of an AC-coupled type distal electrode for an electric scalpel previously provided by the inventors, the plate-shape electrode portion is covered by an insulator, in a construction in which the electrode portion is, so to speak, internalized in the insulator, and the conductor cannot be seen from the surface. Hence even when conduction defects due to cracks or damage to the electrode portion with the passage of time occur, requiring repairs or replacement, the device continues to be used without modification, possibly impeding surgery; and so remedial measures have been desired.

The present device was created in consideration of these circumstances, and has as an object the provision of an AC-coupled type distal electrode, the electrode portion of which cannot be seen from the surface, except terminals and similar, said distal electrode being provided with a monitor electrode portion capable of prompt and accurate discovery of failures occurring in the electrode portion.

Below, this device is explained based on an embodiment, and referring to the drawing.

Fig. 1 shows an AC-coupled type distal electrode 10 for an electric scalpel to which this device is applied. The surface of the plate-shape electrode portion 1 is covered with insulating films 2, 3. The electrode portion 1 may be a metal mesh of copper, aluminum or similar, a layer of fine metal fragments of the same material, or a conductive liquid material or similar; as the insulating films, normally a synthetic resin layer of vinyl chloride, polyethylene or similar with a permittivity of 10 to 20, or an unwoven cloth or similar, is preferably used. A terminal 4 is provided in the electrode portion 1, and is connected to a power supply 6 via a lead wire 5; an AC-coupled circuit is formed by the

patient 9 between [the electrode portion 1] and the blade 8 of the electric scalpel, connected to the end of a lead wire 7 extending from the power supply 6.

Within the distal electrode 10 for the electric scalpel exists a monitor electrode portion 11, shown in Fig. 2, as the characteristic portion of this device. This monitor electrode portion 11 is internalized in the above insulating film (in this example, the part labeled 3), separated from the electrode portion 1, and connected to a lead wire 13 via a terminal 12. As the monitor electrode portion, similarly to the ordinary electrode portion 1, metal mesh, a metal sheet, or other conductor can be used.

Next, the effect of action of the monitor electrode portion is explained.

As described above, the occurrence of cracks or damage in the electrode portion 1 due to bending and stretching or similar during use not only detracts from the performance inherent in the electric scalpel, but also abnormally raises the impedance of the distal electrode, causing shunting of excessive electric currents to the electrode portions of electrocardiographs or other ME [Translator's note: Probably stands for "medical equipment"] used in conjunction with the electric scalpel, so that the electrode portion of the other ME is heated excessively, and accidents involving burns to the patient are not uncommon. Consequently it is extremely important that monitoring be performed to determine whether the function [Translator's note: Possible typo for Japanese *kinou* meaning "function"; the original *kisaku* could be inferred from context as "construction"] of the distal electrode is normal or not. In the case of the distal electrode having a monitor electrode of this device, the electrostatic capacitance between the normal electrode portion 1 and the monitor electrode portion 11 can be monitored. In this case, if the electrostatic capacitance value falls below a reference value, an alarm is sounded. If the electrostatic capacitance between two electrodes is C, then the following equation obtains.

$$C = \varepsilon \varepsilon_0 \frac{S}{d} \qquad \cdots ①$$

Here ε_0 is the permittivity of vacuum, ε is the relative permittivity of the insulator between 1 and 11, d is the thickness of the insulator, and S is the area of the facing [surfaces] of 1 and 11. If a constant AC voltage E (at frequency f) is applied across the two electrodes 1 and 11, and a current I flows, this relation may be expressed as

$$I = \frac{E}{|Z|}$$ where Z is the impedance of C, expressed by

$$|Z| = \frac{1}{2\pi f C}$$ Hence from eq. ①,

$$|Z| = \frac{d}{2\pi f \varepsilon \varepsilon_0 S}$$ and so

$$I = \frac{E 2\pi f \varepsilon \varepsilon_0 S}{d}$$

As explained above, E, f, ε, ε_0, and d are constants, so that the current I is proportional to the area S. That is, if 1 or 11 is cut for some reason, so that the area of the opposing [surfaces] of 1 and 11 changes, this can be detected by monitoring the current I.

If some abnormality is discovered, use of the distal electrode can be stopped immediately, and a measure such as replacement or repair taken, so that surgery is not impeded.

The present device is configured as described above, and can improve the safety of the AC coupled-type distal electrode and ensure safety for surgery, and so is extremely useful.

4. Brief Explanation of the Drawings

Fig. 1 is a figure which explains the AC-coupled type distal electrode for an electric scalpel to which this device is applied; and Fig. 2 is an enlarged cross-sectional view of the distal electrode for an electric scalpel of this device.

1: Electrode portion

2, 3: Insulating film

6: Power supply

8: Electric scalpel blade

11: Monitor electrode portion

Figure 1

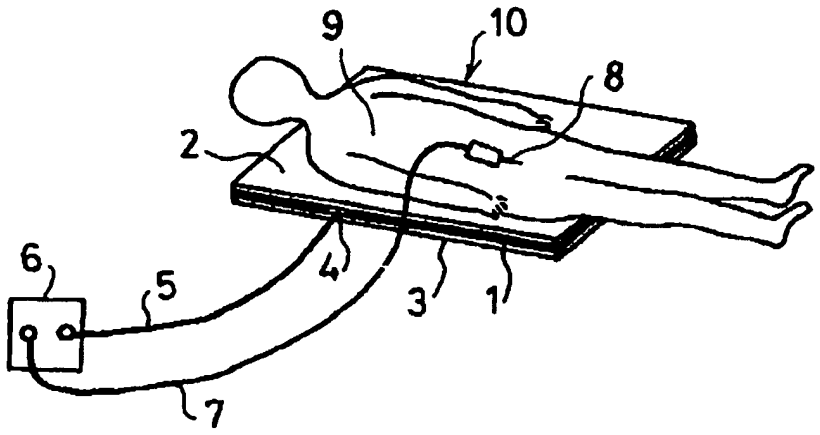
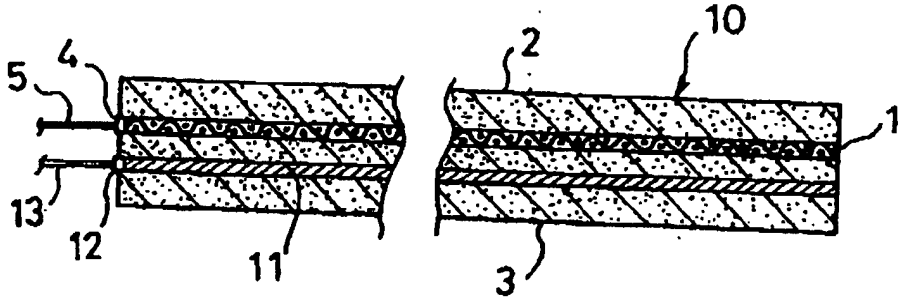


Figure 2



(4,000円)

実用新案登録願(2)

昭和56年3月26日

特許庁長官 島田春樹 殿

1. 考案の名称 電気メス用対極板（デンキ ヨウタイキョクバン）

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5. 添付書類の目録

(1) 明細書	1通	(2) 図面	1通
(3) 願書副本	1通	(4) 委任状	1通
(5) 審査請求書	1通		

特許庁 56.3.26

90 方式審査

56 043133

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明　　細　　書

1. 考案の名称

電気メス用対極板

2. 実用新案登録請求の範囲

電極部の表裏面を絶縁被膜で覆ってなる交流結合型の電気メス用対極板において、上記絶縁被膜に上記電極部と離隔してモニタ電極部を内蔵してあることを特徴とする電気メス用対極板。

3. 考案の詳細な説明

本考案は電極部のほかにモニタ電極部を有する交流結合型の電気メス用対極板に関する。

従来電気メス用対極板は、被術者を直接電極部に載置する方式の直流結合型のものが大部分で、従ってその電極部の表面に金属部分、生理的食塩水又は導電成型物等が現われ、使用前の点検時、使用中の不具合が発生した場合等にはその要修理個所の発見及び処置が容易であった。しかし、本考案者がさきに提供した交流結合型の電気メス用対極板の場合には、平板状の電極部が絶縁体でおおわれていて、いわば、絶縁体に電極部が内蔵さ

れたような構造であるので、導電体は表面からは見えない。従って、経時的に電極部に亀裂や折損等による導通不良を招き修理又は交換を要する場合でもそのまま継続使用して施術に支障を来すことがあり、その対策が要望されていた。

本考案はかかる実情に鑑みてなされたもので、端子等以外表面から電極部の見えない交流結合型の対極板にあって、該電極部に生じた故障を迅速かつ確実に発見しうるモニタ電極部を設けた対極板を提供することをその目的とするものである。

以下図面を参照し実施例に基づいて本考案を説明する。

第１図には、本考案が適用される交流結合型の電気メス用対極板１０が示されている。平板状の電極部１の表裏面には、絶縁被膜２，３が覆われている。電極部１は銅又はアルミ等の金網、同材料の金属細片層、導電性液状物等のいずれでもよく、また、絶縁被膜には通常誘電率１０～２０の塩化ビニル，ポリエチレン等の合成樹脂層又は不織布等が好んで使用される。電極部１には端子４

32

が設けられ、リード線5を介して電源6に結合し、さらに、電源6から延設されるリード線7の先端に連結される電気メスの刃先8との間に被術体9を介して交流結合型の回路が形成される。

かかる電気メス用対極板10において、本考案の特徴部分は第2図に示されるモニタ電極部11に存する。このモニタ電極部11は、前記の絶縁被膜（本例では符号3の部分）に、電極部1から離隔して内蔵せしめられ、端子12を介しリード線13を接続している。モニタ電極部には、通常の電極部1と同様に金属網、金属板其の他の導電体も使用可能である。

次に、かかるモニタ電極部の作用効果について説明する。

前述の如く、使用中の屈伸等に基づく電極部1の亀裂、折損等の発生は、電気メス本来の性能を低下せしめる許りでなく、対極板のインピーダンスを異常に高め、電気メスと併用する心電計等の他のMEの電極部に過大な電流を分流してこの結果該他のMEの電極部を過熱し被術体に火傷を生

ぜしめる事故が少なくない。このため、対極板の機作が正常であるか否かを監視することは極めて重要である。本考案に係るモニタ電極を有する対極板の場合、通常の電極部1とモニタ電極部11との間の静電容量をモニタしうる。この場合静電容量値が規格値に対して下廻ったときには警報が発せられる。ここでふたつの電極間の静電容量をCとすると次式が成り立つ。

$$C = \varepsilon \varepsilon_0 \frac{S}{d} \qquad \cdots ①$$

ここでε_0は真空誘電率、εは1と11との間の絶縁物の比誘電率、dはその絶縁物の厚さ、Sは1と11との対向する面積である。このときこの両極板1，11間に一定の交流電圧E（周波数をfとする）を加えるとIなる電流が流れるこの関係を式で示すと

$I = \frac{E}{|Z|}$ ここでZはCのインピーダンスであり

$|Z| = \frac{1}{2\pi f C}$ で表わされるから①より

$|Z| = \frac{d}{2\pi f \varepsilon \varepsilon_0 S}$ となり

$I = \frac{E 2\pi f \varepsilon \varepsilon_0 S}{d}$ となる。

さきに示したようにE，f，ε，ε_0，dは定数で

あるから電流Ｉは面積Ｓに比例することがわかる。つまり１あるいは１１が何らかの原因で切断されて１，１１の対向する面積が変化した場合Ｉをモニターすることによってこれを検知できることが明確となる。しかして、異常が発見されれば直ちに当該対極板の使用を中止して、交換又は修理等の措置を講ずることができ手術に支障を来たすことがない。

本考案は以上の如く構成されるものであるから交流結合型の耐極板の安全性を高め手術に対する信頼性を確保しうるものであり、極めて有用である。

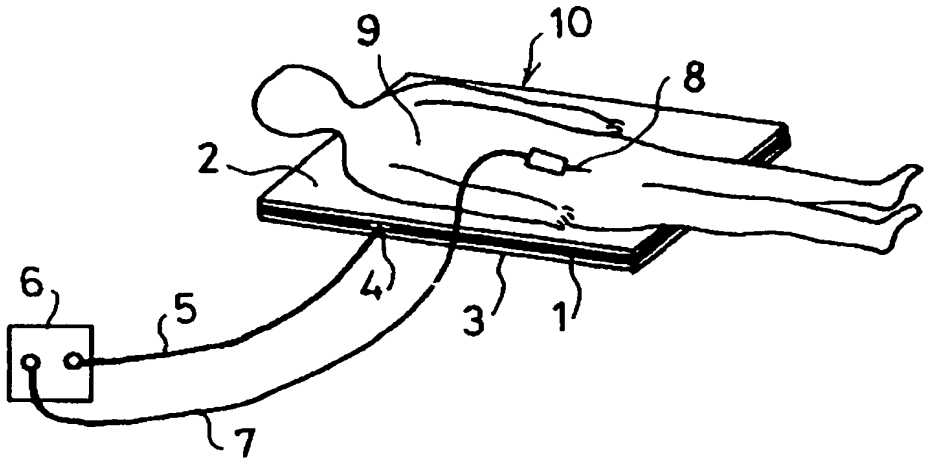
4.図面の簡単な説明

第１図は、本考案が適用される交流結合型の電気メス用対極板を示す説明図、第２図は本考案に係る電気メス用対極板の断面拡大図である。

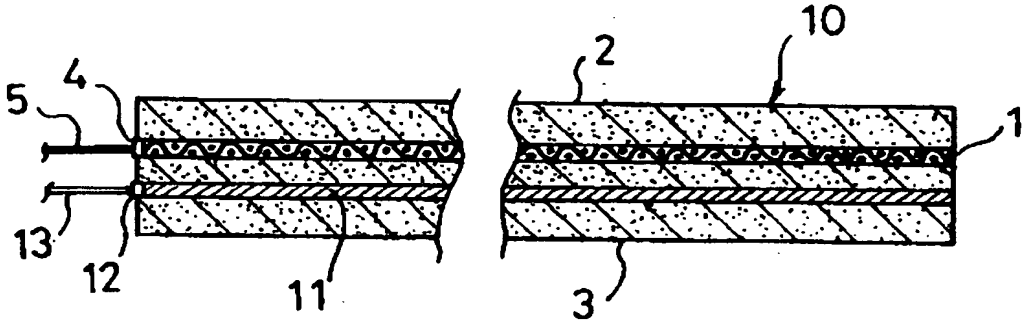
１…電極部、２，３…絶縁被膜、６…電源、８…電気メスの刃先、１１…モニタ電極部。

95

第 1 図



第 2 図



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